

Memorandum

*Flex your power!
Be energy efficient*

To: ALL DESIGN SENIORS
Structure Design
Structure Design Services &
Earthquake Engineering

Date: October 23, 2003

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Structure Maintenance and
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Division of Engineering Services

Subject: Lightweight Masonry Approved for Use on Structures

Currently, the Standard Special Provisions (SSP #562) allow the use of either lightweight or medium weight concrete masonry units on structures. However, Memo to Designers 22-1 prohibits the use of lightweight masonry on structures adjacent to traffic because of a reduction in the resistance to fragmenting upon impact. Due to the current prevalent use of split face four score masonry block, it is desirable to use lightweight masonry on structures to minimize the loads. To mitigate the fragmentation concern, the lower 2440mm of blocks should be fully grouted and bond beams should be placed every 610mm.

To control the load that is on bridges, a maximum block weight is now included in the SSP's. Designers must ensure that the loads used in the calculations correspond to the limits in the specifications.

The Soundwall Design Criteria (MTD 22-1) has been modified to correspond to the 1997 *Uniform Building Code* and the 2002 Revisions to the *AASHTO Guide Specifications for Structural Design of Sound Barriers*.

These are interim guidelines that will remain in effect until Memo to Designers 22-1 is rewritten. Implementation of this practice is immediate for new projects, and should be considered on a case by case basis for ongoing projects. Attached for your reference is the new Soundwall Reference Sheet for Soundwall on Bridge and the Soundwall Design Criteria.

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For more information, please contact Doug Dunrud, Soundwall Technical Specialist, at 227-8111.

Attachments

c: Rob Stott
Roberto Lacalle
Bridge Design Office Chiefs

Sound Wall Design Criteria

The following criteria shall be used when designing sound walls.

I. Loads

Wind Load

For $H \leq 4.27$ m (14 ft);

958 Pa (20 psf) for walls on ground;

1293 Pa (27 psf) for walls on bridge structures, retaining walls, or traffic barriers.

For $H > 4.27$ m (14 ft) and $H \leq 8.84$ m (29 ft);

1197 Pa (25 psf) for walls on ground;

1580 Pa (33 psf) for walls on bridge structures, retaining walls, or traffic barriers.

For $H > 8.84$ m (29 ft);

1341 Pa (28 psf) for walls on ground;

1772 Pa (37 psf) for walls on bridge structures, retaining walls, or traffic barriers.

Where H is the distance from the average level of adjoining ground surface to centroid of loaded area.

Seismic Dead Load

0.57 dead load

2.0 dead load, on bridges.

II. Load Combinations

Working Stress Design (WSD)

Group 1: D + E + SC

Group 2: D + W + SC + E

Group 3: D + EQD/1.4 + E

Percentage of Unit Stress

100%

100%

100%

Where: D = Dead Load
E = Lateral Earth Pressure
SC = Live Load Surcharge
W = Wind Load
EQD = Seismic Dead Load

Load Factor Design (LFD)

Group A: $(\beta \times D) + 1.7 E + 1.7 SC$

Group B: $(\beta \times D) + 1.7 E + 1.3 W$

Group C: $(\beta \times D) + 1.3 E + 1.0 EQE$

Group D: $(\beta \times D) + 1.3 E + 1.0 EQD$

Group E: $(\beta \times D) + 1.1 E + 0.85 (EQE + EQD)$

Where: β = 0.9 or 1.2, whichever controls in Design
D = Dead Load
E = Lateral Earth Pressure
SC = Live Load Surcharge
W = Wind Load
EQE = Seismic Earth Load
EQD = Seismic Dead Load

The Strength Reduction Factors, ϕ

Reinforced Concrete:

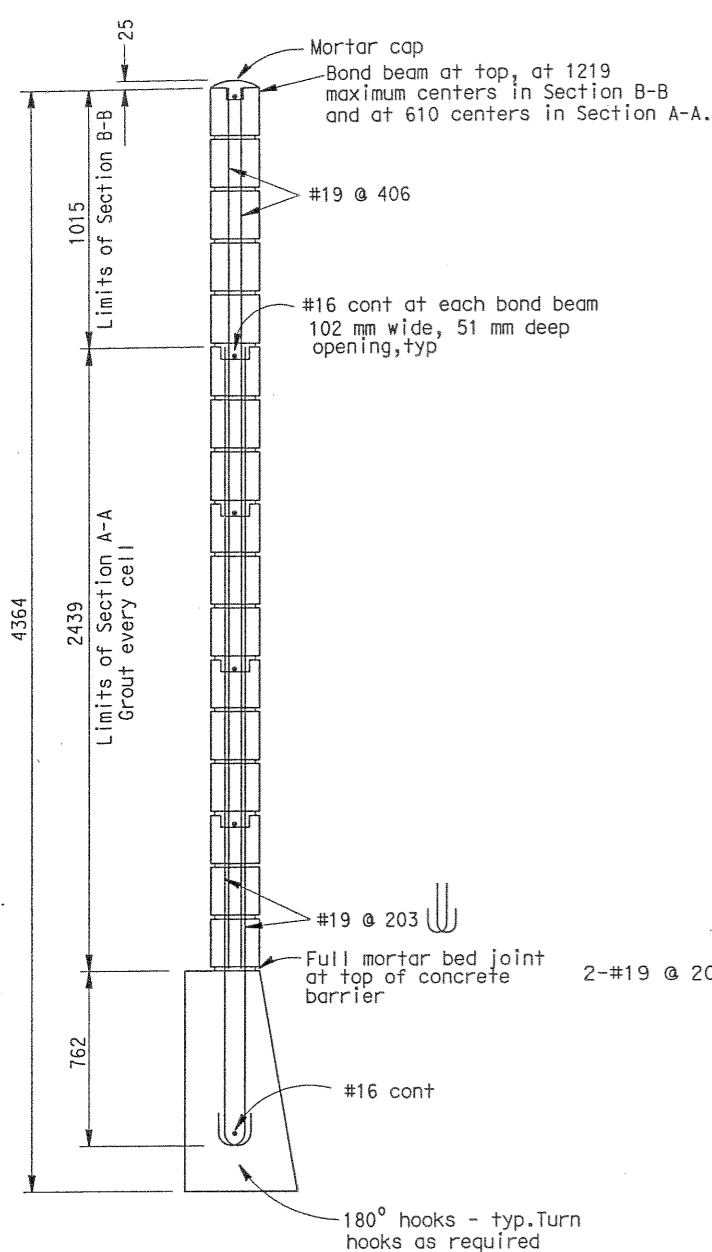
For Flexure..... $\phi = 0.90$

For Shear..... $\phi = 0.85$

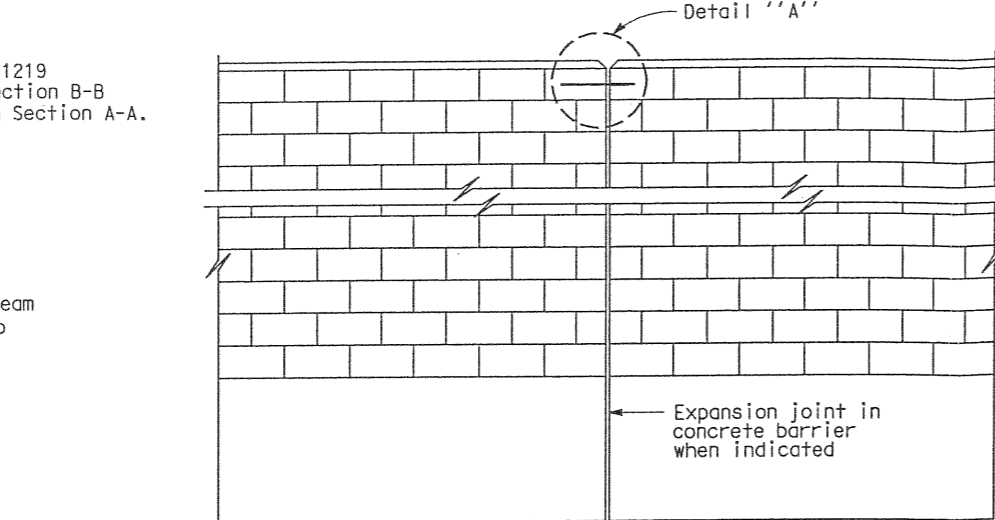
Concrete Masonry:

For Flexure..... $\phi = 0.80$

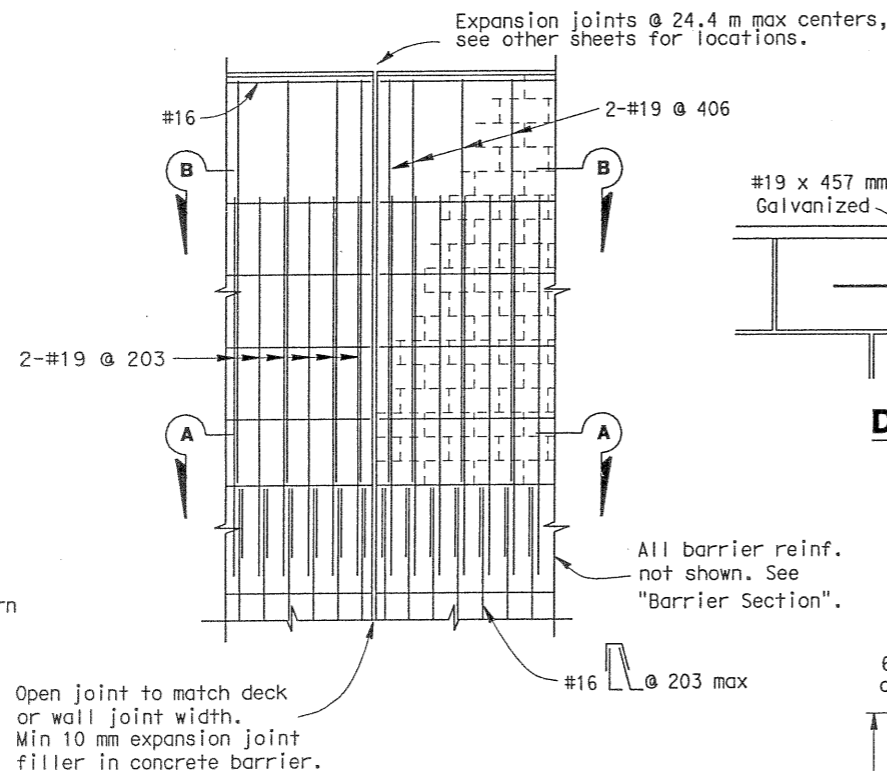
For Shear..... $\phi = 0.60$



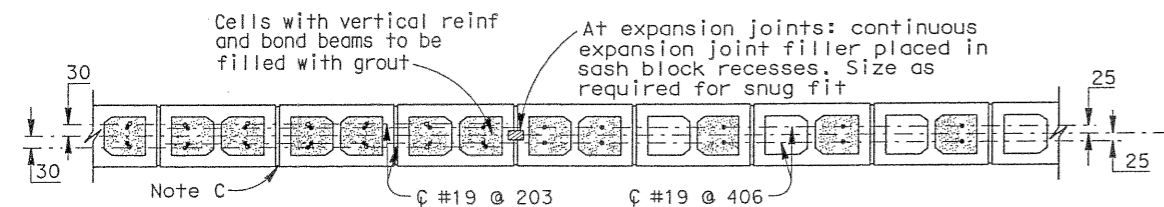
SOUND WALL SECTION



ALIGNMENT KEY DETAIL

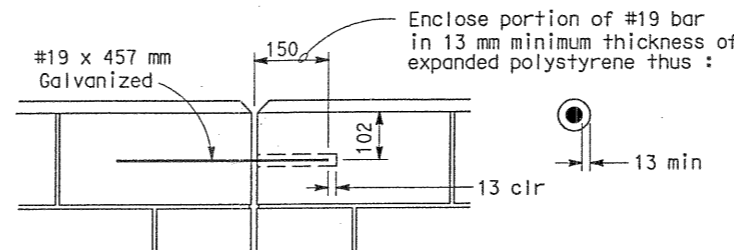


DECK AND WALL JOINT ELEVATION

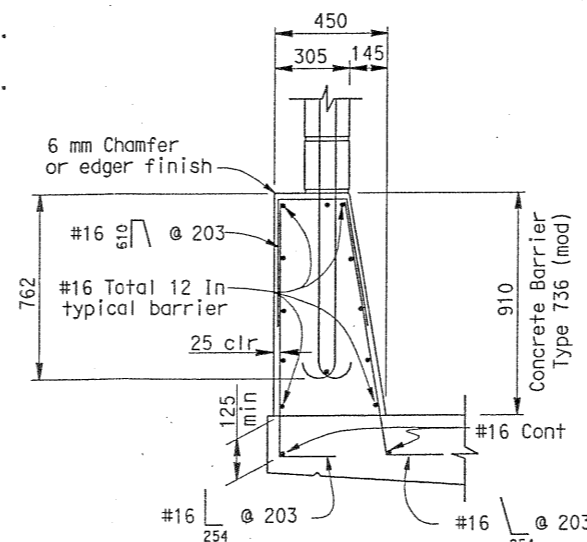


SECTION A-A

SECTION B-B



DETAIL A



NOTE
For dimensions and reinforcement not shown,
see Std. Plan B11-56

BARRIER SECTION

GENERAL NOTES

- Note A: For type of block, type of block bond and joint finish, see other sheets.
- Note B: When blocks are laid in stacked bond, ladder type, galvanized joint reinforcement shall be provided. A minimum of 2 - 3.76 mm wires continuous at 1219 maximum to be used. Locate reinforcement in joints that are at the approximate midpoint between bond beams.
- Note C: Horizontal joints shall be tooled concave or may be weathered. Vertical joints shall be tooled concave or may be raked.
- Note D: All masonry to be high strength unless otherwise noted.
- Note E: Class 2 concrete to be used for barrier.
- Note F: Expansion joints in concrete barrier and masonry block to match deck joints and at ends of wing walls.
- Note G: Expansion joints in Sound Wall (Masonry Block) shall be at each support, center of span, and at ends of each wingwall.
- Note H: For dimensions and reinforcement not shown see "Typical Section" sheet.

DESIGN NOTES

DESIGN

Uniform Building Code, 1997 Edition and the Bridge Design Specifications.

DESIGN WIND LOAD

1440 Pa

DESIGN SEISMIC LOAD

2.0 Dead load

REINFORCED CONCRETE

$f'_c = 22.41 \text{ Mpa}$
 $f_y = 413.7 \text{ MPa}$

CONCRETE MASONRY

HIGH STRENGTH
 $f'_m = 17.24 \text{ MPa}$
 $f_y = 413.7 \text{ MPa}$

LOAD FACTORS AND LOAD COMBINATIONS

Load Factor Design (LFD)

Group A: BD +1.7 E + 1.7 SC
Group B: BD +1.7 E + 1.3 W
Group C: BD +1.3 E + 1.0 EQE
Group D: BD +1.3 E + 1.0 EQD
Group E: BD +1.1 E + 0.85 (EQE + EQD)

Where : $\beta = 0.9$ or 1.2 , whichever controls in design

D = Dead load
E = Lateral earth pressure
SC = Live load surcharge
W = Wind load
EQD = Seismic dead load
EQE = Seismic earth load

STRENGTH REDUCTION FACTORS, ϕ

Reinforced Concrete :

For flexure $\phi = 0.90$
For shear $\phi = 0.85$

Concrete masonry:

For flexure $\phi = 0.80$
For shear $\phi = 0.60$

Note 1:

Barrier, Deck and Concrete Masonry are designed by the Strength Design Method.

NO SCALE
ALL DIMENSIONS ARE IN
MILLIMETERS UNLESS OTHERWISE SHOWN

STANDARD DRAWING				STATE OF CALIFORNIA		DIVISION OF STRUCTURES		BRIDGE NO.	
FILE NO.	DESIGN	BY	CHECKED	APPROVAL	RECOMMENDED BY	STRUCTURE DESIGN		KILOMETER POST	
DRAWING DATE	07/03	BY	CHECKED					SOUNDWALL - MASONRY BLOCK ON BRIDGE	
SUBMITTED BY				DESIGN SUPERVISOR		CU		REVISION DATES (PRELIMINARY STAGE ONLY)	
DS OSD 2147A (METRIC) (REV. X/XX/XX)				ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS		EA		DISREGARD PRINTS BEARING EARLIER REVISION DATES	
								7/25/03 10/10/03	
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